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Junxing Shen

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PATENT LAW GROUP LLP  
2635 NORTH FIRST STREET  
SUITE 223  
SAN JOSE, CA 95134

EXAMINER

THOMAS, MIA M

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/692,666	<b>Applicant(s)</b> SHEN ET AL.	
	<b>Examiner</b> Mia M. Thomas	<b>Art Unit</b> 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 September 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-13 and 15-18 is/are rejected.
- 7) ☐ Claim(s) 9, 14, 19 and 20 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 September 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. This Office Action is responsive to applicant remarks received on 08 September 2008. Claims 1-20 remain pending.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-5, 16 and 17 rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki (US 7,215,812 B1) in combination with Pollard (US 2004/0028271 A1) and Pavlidis (US 7,149,325 B2).

**Regarding Claim 1:** Masaki teaches a method for color matching a first image and a second image, wherein a first region of the first image and a second region of the second image overlap ("An image processing method for carrying out predetermined correction processing with respect to one or more items regarding the quality of color images..."at abstract), the method comprising:

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generating a first histogram of the first region (Refer to Figure 5);

generating a second histogram of the second region (Refer to Figure 5);

determining corresponding pixel values from the first and the second histograms (Refer to Figure 4, numeral #51);

Pollard teaches determining at least one parameter of an optoelectronic conversion function (OECF) that best matches the corresponding pixel values ("The processing itself may be performed according to the steps outlined in the flow-chart of FIG. 7. These include a pre-processing stage 92, which may typically include correction of the OECF (opto-electronic conversion function) of the sensor and white-balancing to compensate for variations in illumination." at paragraph [0108])

and color matching the second image to the first image by applying the OECF with the at least one parameter to the second image ("Following the colour correction and de-mosaicing stage 94 described above, a subsequent post-processing stage 96 may include exposure correction (which can also be accomplished at the preprocessing stage) and transformation to a standard colour space such as RGB (as described in IEC 61966-2-1)." at paragraph [0108]).

By way of example, Pavlidis teaches a method for color matching a first image and a second image, wherein a first region of the first image and a second region of the second image overlap (Refer to Figures 16a-16d). The Examiner is stating that Figure 16a is a first image and Figure 16b is a second image. For clarity, Figure 16a is an image of a house where "the man" is not present, while Figure 16b is another image where "the man" is present in front of the house. Figures 16c - 16d show where the features of the images overlap, specifically with reference to

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Figure 16b and 16d. For clarity, "the man" and the lower window section (area where "the man" is standing in front of) overlap.

Pavlidis teaches generating a first histogram of the first region (Refer to Figure 17a-17b); generating a second histogram of the second region (Refer to Figure 17a-17b); Further at column 26, line 25. For clarity, the Examiner is stating that in the statement "There may be similar histograms for the colors green and blue of image 322. Since there are a three color regions associated with image 322, there are multiple histograms that can be created as demonstrated in Figure 17a.

determining corresponding pixel values from the first and the second histograms (Refer to column 26, line 25-36).

Masaki, Pollard and Pavlidis are combinable because they are in the same field of color image processing, specifically, color correction. (See title and abstract of each invention).

All the claimed elements were known in the prior art and one skilled in the art could have combined the elements as disclosed/taught by Masaki, Pollard and Pavlidis by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

All of the components as discloses/taught by Masaki could have been easily combined with both the teachings of Pollard and Pavlidis and yielded predictable results such as the specified claimed elements as claimed in claim 1. Therefore, at the time of the invention, the skilled

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artisan could have combined all the claimed elements as disclosed/taught by Masaki, Pollard and Pavlidis and obtained all the claimed elements of Claim 1.

**Regarding Claim 2:** Masaki teaches prior to said generating a first histogram and generating a second histogram: removing a percentage of the overlapping pixels with the greatest difference in brightness (By way of example, refer to Figure 4, numeral #45).

**Regarding Claim 3:** Masaki teaches said generating a first histogram comprises recording in a first plurality of pixel value bins a first plurality of numbers of pixels that have respective pixel values in the first region (Refer to Figures #41 and #43); and said generating a second histogram comprises recording in a second plurality of pixel value bins a second plurality of numbers of pixels that have the respective pixel values in the second region (Refer to Figures #49 and #51).

**Regarding Claim 4:** Masaki teaches determining corresponding pixel values in the first and the second histograms comprises generating a lookup table (LUT) storing a third plurality of numbers of pixels and their corresponding pixel values (Refer to Figure 1, numeral 202, further refer to column 4, line 22).

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**Regarding Claim 5:** Masaki teaches generating a lookup table comprises:

- (1) initializing all entries in the LUT to 0;
- (2) initializing a first loop by setting  $i = 0$ ;  $j = 0$ ;  $rem1 = h1[0]$ ; and  $rem2 = h2[0]$ ;
- (3) updating the LUT by setting  $min\_rem = \min(rem1, rem2)$ ;  $rem1 = rem1 - min\_rem$ ; and  $rem2 = rem2 - min\_rem$ ; and incrementing  $LUT[i][j]$  by  $min\_rem$ ;
- (4) if  $rem1 = 0$ , then incrementing  $i$  and setting  $rem1 = h1[i]$ ;
- (5) if  $rem2 = 0$ , then incrementing  $j$  and setting  $rem2 = h2[j]$ ;
- (6) if  $i < 256$  and  $j < 256$ , then repeating steps (3) to (5);

wherein  $h1[ ]$  is the number of pixels having a certain pixel value in the first histogram,  $h2[ ]$  is the number of pixels having a certain pixel value in the second histogram, and  $LUT[ ][ ]$  is the number of pairs of corresponding pixel values having a certain pixel value in the first histogram and a certain pixel value in the second histogram (Refer to Figure 1, numeral 203).

**Regarding Claim 16:** Masaki teaches a method for color matching a first image and a second image, wherein a first region of the first image and a second region of the second image overlap ("An image processing method for carrying out predetermined correction processing with respect to one or more items regarding the quality of color images..." at abstract), the method comprising: removing a percentage of overlapping pixels with the greatest difference in brightness (Refer to Figure 4, numeral #45); generating a first histogram of the first region and a second histogram of the second region after said removing (Refer to Figure 5); histogram matching the first and the second histogram to determine corresponding pixel values from the

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first and the second histograms (Refer to Figure 4, numeral #43-#47); minimizing a color matching error between the corresponding pixel values, wherein the color matching error is generated from an optoelectronic conversion function (OECF) (Refer to Figure 4, numeral #41); and color matching the second image to the first image by applying the OECF to the second image (Refer to Figure 4, numerals #53-#59).

**Referring to Claim 17:** Masaki teaches the method of claim 16, wherein said histogram matching the first and the second histograms comprises generating a lookup table (LUT) as follows: (1) initializing all entries in the LUT to 0;

- (2) initializing a first loop by setting  $i = 0$ ;  $j = 0$ ;  $rem1 = h1[0]$ ; and  $rem2 = h2[0]$ ;
- (3) updating the LUT by setting  $min\_rem = \min(rem1, rem2)$ ;  $rem1 = rem1 - min\_rem$ ; and  $rem2 = rem2 - min\_rem$ ; and incrementing  $LUT[i][j]$  by  $min\_rem$ ;
- (4) if  $rem1 = 0$ , then incrementing  $i$  and setting  $rem1 = h1[i]$ ;
- (5) if  $rem2 = 0$ , then incrementing  $j$  and setting  $rem2 = h2[j]$ ;
- (6) if  $i < 256$  and  $j < 256$ , then repeating steps (3) to (5);

wherein  $h1[ ]$  is the number of pixels having a certain pixel value in the first histogram,  $h2[ ]$  is the number of pixels having a certain pixel value in the second histogram, and  $LUT[ ][ ]$  is the number of pairs of corresponding pixel values having a certain pixel value in the first histogram and a certain pixel value in the second histogram (Refer to Figure 1, numeral 203).



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**Claim Rejections - 35 USC § 103**

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 6-7, 10-13, 15, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki (US 7,215,812 B1) in combination with Pollard (US 2004/0028271 A1) and Pavlidis (US 7,149,325 B2), further in view of Hasler "Modeling the Opto-Electronic Conversion Function (OECF) For Application in the Stitching of Panoramic Images, hereinafter referred to as Hasler-(MOASPI).

**Regarding Claim 6:** Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically teach at least one parameter of an OECF comprises minimizing a color matching error, the color matching error being defined

$$e = \sum_{i=0}^{255} \sum_{j=0}^{255} LUT[i][j] ((i+1)/256.0 - S^{-1}(rS((j+1)/256.0)))^2,$$

as:

wherein  $e$  is

the color matching error,  $r$  is a color matching parameter, and  $S(\cdot)$  is the OECF

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Hasler – (MOASPI) teaches determining at least one parameter of an OECF comprises minimizing a color matching error, the color matching error being defined as:

$$e = \sum_{i=0}^{255} \sum_{j=0}^{255} LUT[i][j]((i+1)/256.0 - S^{-1}(S((j+1)/256.0))),$$

wherein  $e$  is the color matching error,  $r$  is a color matching parameter, and  $S( )$  is the OECF (Refer to Equation 2b, right column, section 4, "The Error Metric").

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Masaki, Pollard and Pavlidis with the teachings as taught by Hasler, specifically at Equation 2b, to define the color matching error to be the determination and defining elements of the OECF to determine a parameter for application

The suggestion/motivation for combining all these claimed elements would be because these function "creates parameters that account for the difference in exposure of the two pictures" as disclosed in the claimed invention.

Therefore, at the time of the invention, the skilled artisan could have combined the teachings/disclosure of the combination of Masaki, Pollard and Pavlidis with the teachings of Hasler to obtain the specified claimed elements of claim 6.

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**Regarding Claim 7:** Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically disclose the OECF is

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

defined as: , wherein x is a pixel value normalized to (0,1), and a epsilon.(-1,1) is another color matching parameter.

Hasler-- (MOASPI) teaches the method of claim 6, wherein the OECF is defined as:

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

, wherein x is a pixel value normalized to (0,1), and a epsilon.(-1,1) is another color matching parameter (Refer to Equation 1, right column, section 3, "The OECF Model").

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

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At the time the invention was made, it would have been obvious to one of ordinary skill in the art to define the OECF as taught by Hasler.

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because these teachings create a function which "creates parameters that account for the difference in exposure of the two pictures" as disclosed in the claimed invention.

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 7.

**Regarding Claim 10:** Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically teach applying the

optoelectronic conversion function comprises:  $x_c = S^{-1}(W(\tau, x_o)S(x_o))$ , wherein  $x(o)$  is an original pixel value in the second image,  $x(c)$  is a corrected pixel value in the second image,  $S^{-1}()$  is the inverse of the OECF, and  $W$  is a weight function defined as:

$$W(\tau, x_i) = \tau + (1 - \tau)x_i.$$

Hasler- (MOASPI) teaches applying the optoelectronic conversion function comprises:

$x_c = S^{-1}(W(\tau, x_o)S(x_o))$ , wherein  $x(o)$  is an original pixel value in the second image,  $x(c)$  is a

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corrected pixel value in the second image,  $S_{sup}^{-1}()$  is the inverse of the OECF, and  $W$  is a

weight function defined as:  $W(r, x_i) = r + (1-r)x_i$ . (Refer to Equation 4, left column, section 5, "The Complete Model").

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functions.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to apply the inverse of the OECF as taught by Hasler.

All of the claimed elements were known in the prior art at the time of the invention and the combination of these disclosed elements would have yielded predictable results to the skilled artisan at the time of the invention.

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because "it will avoid the degenerate solution and is convenient to approximate." (Hasler, page 2, paragraph 3).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 10.

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**Regarding Claim 11:**

Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically disclose the OECF is defined as:

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

wherein  $S(x)$  is the OECF,  $x$  is a pixel value normalized to (0, 1), and  $a(\epsilon)(-1,1)$  is a first color matching parameter

Hasler– (MOASPI) teaches the OECF is defined as:

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

wherein  $S(x)$  is the OECF,  $x$  is a pixel value normalized to (0,1), and  $a(\epsilon)(-1,1)$  is a first color matching parameter (Refer to Equation 1, right column, section 3, “The OECF Model”).

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

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At the time the invention was made, it would have been obvious to one of ordinary skill in the art to define the OECF is defined as:

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

wherein  $S(\cdot)$  is the OECF,  $x$  is a pixel value normalized to (0,1), and  $a(\epsilon)(-1,1)$  is a first color matching parameter.

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because the OECF with these definitive elements can “deliver an optimal result in a least square error sense.” (Hasler, abstract)

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 11.

### **Regarding Claim 12:**

Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically teach determining at least one parameter of

an OECF comprises minimizing a color matching error defined as:

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$$e = \sum_{x_1 \in R_1, x_2 \in R_2} \|x_1 - S^{-1}(\tau S(x_2))\|^2,$$

wherein  $e$  is the color matching error,  $x_{\text{sub.1}}$  and  $x_{\text{sub.2}}$  are corresponding pixel values in the first and the second regions,  $R_{\text{sub.1}}$  and  $R_{\text{sub.2}}$  are the first and the second regions,  $S(\cdot)$  is the OECF,  $S(\cdot)^{\text{sup.-1}}$  is the inverse OECF, and  $(\tau)$  is a second color matching parameter.

Hasler— (MOASPI) teaches determining at least one parameter of an OECF comprises minimizing a color matching error defined as:

$$e = \sum_{x_1 \in R_1, x_2 \in R_2} \|x_1 - S^{-1}(\tau S(x_2))\|^2,$$

wherein  $e$  is the color matching error,  $x_{\text{sub.1}}$  and  $x_{\text{sub.2}}$  are corresponding pixel values in the first and the second regions,  $R_{\text{sub.1}}$  and  $R_{\text{sub.2}}$  are the first and the second regions,  $S(\cdot)$  is the OECF,  $S(\cdot)^{\text{sup.-1}}$  is the inverse OECF, and  $(\tau)$  is a second color matching parameter (Refer to Equation 2d, left column, paragraph 2, section 4 “The Error Metric”).

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).



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At the time the invention was made, it would have been obvious to one of ordinary skill in the art to determining at least one parameter of an OECF comprises minimizing a color matching error defined as:

$$e = \sum_{x_1 \in R_1, x_2 \in R_2} \|x_1 - S^{-1}(\tau S(x_2))\|^2,$$

wherein  $e$  is the color matching error,  $x_{\text{sub.1}}$  and  $x_{\text{sub.2}}$  are corresponding pixel values in the first and the second regions,  $R_{\text{sub.1}}$  and  $R_{\text{sub.2}}$  are the first and the second regions,  $S(\cdot)$  is the OECF,  $S(\cdot)^{-1}$  is the inverse OECF, and  $(\tau)$  is a second color matching parameter.

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because this color matching error as “defined applies to the region of the histogram that contains most of the data still delivering a small error.” (Hasler, page 2, right column, 2<sup>nd</sup> paragraph).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 12.

### **Regarding Claim 13:**

Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

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The combination of Masaki, Pollard and Pavlidis does not specifically teach minimizing a color matching error comprises performing a golden section search of the color matching error.

Hasler— (MOASPI) teaches minimizing a color matching error comprises performing a golden section search of the color matching error (For example, refer to equations (10.1.6) and (10.1.7) in reference to the golden mean or golden section search examples).

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to minimizing a color matching error comprises performing a golden section search of the color matching error.

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because “the golden section search guarantees that each new function evaluation will bracket minimum to an interval a precise number times the size of the preceding interval.” (Press, page 399-400, last paragraph, final sentence).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 13.

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**Regarding Claim 15:**

Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically disclose applying the

OECF comprises:  $x_c = S^{-1}(W(\tau, x_o)S(x_o))$ , wherein  $x(o)$  is an original pixel value in the second image,  $x(c)$  is a corrected pixel value in the

second image, and  $W$  is a weight function defined as:  $W(\tau, x_c) = \tau + (1 - \tau)x_c$ .

Hasler-- (MOASPI) teaches applying the OECF comprises:  $x_c = S^{-1}(W(\tau, x_o)S(x_o))$ , wherein  $x(o)$  is an original pixel value in the second image,  $x(c)$  is a corrected pixel value in the

second image, and  $W$  is a weight function defined as:  $W(\tau, x_c) = \tau + (1 - \tau)x_c$ . (Refer to Equation 4, left column, section 5, "The Complete Model").

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

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At the time the invention was made, it would have been obvious to one of ordinary skill in the art

to apply the OECF comprises:  $x_c = S^{-1}(W(\tau, x_o)S(x_o))$ , wherein  $x(o)$  is an original pixel value in the second image,  $x(c)$  is a corrected pixel value in the

second image, and  $W$  is a weight function defined as:  $W(\tau, x_i) = \tau + (1 - \tau)x_i$ .

The suggestion/motivation to combine the teachings/disclosure of Masaki, Pollard and Pavlidis with Hasler would be because with the application of Equation 4(Hasler), applies the gains to adjust the white points and reapply the OECF." (Hasler, page 2, section 5, paragraph 2).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 15.

### Regarding Claim 18:

Masaki in combination with Pollard and Pavlidis discloses/teaches all the claimed elements as listed above.

The combination of Masaki, Pollard and Pavlidis does not specifically disclose determining parameters of the OECF comprises minimizing a color matching error, the color matching error

$$e = \sum_{i=0}^{255} \sum_{j=0}^{255} LUT[i][j]((i+1)/256.0 - S^{-1}(S((j+1)/256.0))),$$

being defined as:

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wherein  $e$  is the color matching error,  $(\tau)$  is a color matching parameter and  $S(x)$  is the OECF

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

defined as:

wherein  $S(x)$  is the OECF,  $x$  is a pixel value

normalized to (0,1), and  $a(\epsilon)(-1,1)$  is another color matching parameter.

Hasler – (MOASPI) teaches determining parameters of the OECF comprises minimizing a color matching error, the color matching error being defined as:

$$e = \sum_{i=0}^{255} \sum_{j=0}^{255} LUT[i][j]((i+1)/256.0 - S^{-1}(\tau S((j+1)/256.0))),$$

wherein  $e$  is the color matching error,  $\tau$  is a color matching parameter (Refer to Equation 2b, right column, section 4, "The Error Metric"); and  $S(x)$  is the OECF defined as:

$$S(x) = x + \frac{2}{\pi} \arctan\left(\frac{a \sin(\pi x)}{1 - a \cos(\pi x)}\right),$$

wherein  $S(x)$  is the OECF,  $x$  is a pixel value normalized

to (0,1), and  $a(\epsilon)(-1,1)$  is another color matching parameter (Refer to Equation 1, right column, section 3, "The OECF Model").

Masaki, Pollard, Pavlidis and Hasler are combinable because they are in the same field of image segmenting in panoramic images and opto-electronic conversion functionality. (See title and abstract of each invention).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to further define the OECF function as disclosed by Masaki, with reference to Equation 1, right column, section 3, "The OECF Model" as taught by Hasler because "the OECF with these

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definitive elements can “deliver an optimal result in a least square error sense.” (Hasler, abstract).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard and Pavlidis with Hasler to obtain the specified claimed elements of Claim 18.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki (US 7,215,812 B1) in combination with Pollard (US 2004/0028271 A1) and Pavlidis (US 7,149,325 B2), further in view of Hasler “Modeling the Opto-Electronic Conversion Function (OECF) For Application in the Stitching of Panoramic Images, hereinafter referred to as Hasler- (MOASPI) and Press, “The Art of Scientific Computing, 10.1 Golden Search in One Dimension”-hereinafter referred to as Press.

**Regarding Claim 8:** Masaki in combination with Pollard, Pavlidis and Hasler discloses/teaches all the claimed elements as listed above.

The combination of Masaki and Hasler does not specifically disclose wherein said minimizing a color matching error comprises performing a golden section search of the color matching error.

Press teaches minimizing a color matching error comprises performing a golden section search of the color matching error (For example, refer to equations (10.1.6) and (10.1.7) in reference to the golden mean or golden section search examples).

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Masaki, Pollard, Pavlidis, Hasler and Press are combinable because they are in the same field of color correction with specific reference to a search (see page 397, paragraph 1, Press).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to perform a golden section search of the color matching error as illustrated through examples from Press.

The suggestion/motivation to combine all the claimed elements as rejected above would be because "the golden section search guarantees that each new function evaluation will bracket minimum values to an interval at a precise number times the size of the preceding interval." (Press, page 399-400, last paragraph, final sentence).

Therefore, at the time of the invention, it would have been obvious to the skilled artisan to combine Masaki, Pollard, Pavlidis, Hasler and Press to obtain the specified claimed elements of Claim 8.

#### ***Allowable Subject Matter***

7. Claims 9, 14, 19 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

#### ***Response to Arguments***

Applicant's arguments filed 08 September 2008 have been fully considered and a complete response to those remarks is provided below.

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8. Overall Summary of Remarks: Addressing Claim 1, the Examiner cited Masaki, Pollard and Pavlidis. Applicant respectfully traverses.

Examiner's Response: Applicant's arguments filed 08 September 2008 have been fully considered but they are not persuasive.

For all of the reasons stated at pages 9-11 of applicant's remarks, Applicant believes that Claim 1 is patentable over Masaki, Pollard and Pavlidis et al.

The Examiner notes that in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

However, the Examiner will respond accordingly to the remarks as follows below.

Summary of Remarks:

A. At page 9, with regards to Masaki Applicant states that "Fig 5 does not show histograms of two regions, let along overlapping regions of two images.

Examiner's Response:

B. The Examiner respectfully disagrees. At Column 5, lines 3-6, 60-64 and Column 6, lines 6-19, Masaki teaches that the "judgment" or in other words the matching parameters are determined as to whether the color image is a sunset scene or not. Further since the contrast judgment can use the histograms of the image data created at the time of the sunset judgment



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and the color covering judgment, a photographed image has sharp edges just as a photographed scene taken in cloudy weather although its contrast is low. This teaching demonstrated that there are multiple images take to create histograms (first and second histograms) that have overlapping features. It clearly is taught that the image with the sharp edges is analyzed, similarly, the image with cloudy weather is analyzed. Masaki more that adequately teaches a first histogram and a second histogram on a first and second image are taught in this reference.

Summary of Remarks:

C. At page 10, paragraph 1, "Paragraph [0108] of Pollard et al. only discloses that pre-processing step 92 includes performing a correction of the OECF of a camera sensor. It does not disclose determining any parameter of the OECF that best matches corresponding pixels in the two regions."

Examiner's Response:

D. Examiner respectfully disagrees. Although the applicant has suggested that Pollard only teaches "performing correction of the OECF of a camera sensor", further at paragraph [0108], Pollard further teaches that the RGB image data is reconstructed and compressed and stored in long term memory. Additionally at paragraph [0110], Pollard also teaches that the embodiment of the invention has been described with reference to the Bayer pattern of image pixels, but the invention is also applicable to cases where not all rows and/or columns contain image pixels of at least two colors. The invention is equally applicable to such image mosaics.

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The Examiner is stating that Masaki in combination with Pollard teaches the claimed elements of Claim 1. The processing that occurs in Pollard along with the combination of the processing of the histograms as taught by Masaki more than adequately teaches these claimed limitations.

Summary of Remarks:

E. At page 11, paragraph 1, "The third claim element of claim 1 recited determining corresponding pixels from the two histograms. The Examiner argued that col 26, lines 25 to 36 of Pavlidis et al discloses the same.

Examiner's Response:

F. Examiner respectfully disagrees. Figure 15, numeral 325 teaches 3 histograms and column 25, lines 39-46 specifically teaches "the color signature of images 322 goes to a compare and match unit or component 325. The color signature of image 322 is compared with other signatures in the database 325 and matched with one that have a matching value of a predetermined value or greater. This element more than adequately teaches determining corresponding pixels from two histograms.

The Examiner would like to reiterate that all the claimed elements were known in the prior art at the time of the invention. The skilled artisan could have combined the elements of the teachings of Masaki, Pollard and Pavlidis by known methods with no change in their respective functions and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention. The combination of the teachings of Masaki, Pollard and Pavlidis meets the claimed limitations of claim 1.

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The rejections of claims 2-5, and 17 also stand. Claims 6-8, 10-13, 15 and 18 also stand.

The Examiner indicated that claims 9, 14 and 19 are allowable if rewritten in independent form including all the limitations of their base claims and any intervening claims. The Examiner has also included that claim 20 is also allowable if rewritten in independent form including all the limitations of their base claims and any intervening claims.

### ***Conclusion***

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*/Mia M Thomas/*  
Examiner, Art Unit 2624

/Brian P. Werner/  
Supervisory Patent Examiner, Art Unit 2624